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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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EXAMINER	
SINGH, RAMNANDAN P	
ART UNIT	**PAPER NUMBER**
2644	02

DATE MAILED: 08/11/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	09/465,228	KIM, BEOMSUP	
	Examiner	Art Unit	
	Ramnandan Singh	2644	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *15 April 2004*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *32-115* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *32-115* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *15 August 2000* is/are: a)☐ accepted or b)☒ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date *17/4-15-2004*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Response to Arguments

1. Applicant's arguments file on 25 May 2004 have been considered but are moot in view of the new ground(s) of rejection.

2. **Status of Claims**

New claims 79-115 are added.

Claims 32-115 are pending.

Drawings

3. The drawings were received on 15 April 2004. These drawings are figures 5 and 6. These figures are approved.

4. The equation in Fig. 7a at step 415 is in error. Replace α^2 with σ^2.

Claim Rejections - 35 USC § 112

5. The following is a quotation of the first paragraph of 35 U.S.C. 112:

> The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

6. Claims 32, 34, 41, 50, 51, 60, 69, 70, 79, 81, 83, 85, 87, 89, 91, 93, 95, 97, 99, 100, 102, 103, 105, 107, 110, 112 and 114 are rejected under 35 U.S.C. 112, first

paragraph, as failing to comply with the written description requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention.

Claim 32 recites the limitation "the plurality of filter coefficients for a **current time period** are a weighted sum of corresponding coefficients from a **previous time period** and a product of a signal received by the receiver during **the current (time) period** and a signal transmitted by the transmitter delayed by a predetermined time" in lines 7-10.

The Applicant's specification and drawing show the following:
" the plurality of filter coefficients for a **current time period** are a weighted sum of corresponding coefficients from a **previous time period** and a product of a signal received by the receiver during **the previous time period** and a signal transmitted by the transmitter delayed by a predetermined time" [Applicant's Specification: Equation (1), pages 18-19; Equation (2) , page 21; Fig. 7a]. Clearly, **the disclosure does not support the claimed invention**. A similar thing holds for claims 34, 41, 50, 51, 60, 69, 70, 79, 81, 83, 85, 87, 89, 91, 93, 95, 97, 99, 100, 102, 103, 105, 107, 110, 112 and 114. For this Office action, the examiner assumes that the signal received by the receiver is the signal received during **the previous time period.**

Double Patenting

7. Claims 40, 46, 49, 56, 59, 65, 68, 75, 78, 80, 82, 84, 86, 88, 90, 92, 94, 96, 98, 101, 106, 109, 111 and 115 are objected to under 37 CFR 1.75 as being a substantial duplicate of claim 37. When two claims in an application are duplicates or else are so close in content that they both cover the same thing, despite a slight difference in wording, it is proper after allowing one claim to object to the other as being a substantial duplicate of the allowed claim. See MPEP § 706.03(k), and **MPEP § 2173.05(n)** for **undue multiplicity**.

8. Claims 39, 45, 48, 55, 58, 64, 67, 74 and 77 are objected to under 37 CFR 1.75 as being a substantial duplicate of claim 36. When two claims in an application are duplicates or else are so close in content that they both cover the same thing, despite a slight difference in wording, it is proper after allowing one claim to object to the other as being a substantial duplicate of the allowed claim. See MPEP § 706.03(k), and **MPEP § 2173.05(n) for undue multiplicity**.

9. Claims 81, 83, 85, 87, 89, 91, 93, 95, 97, 100, 105, and 114 are objected to under 37 CFR 1.75 as being a substantial duplicate of claim 79. When two claims in an application are duplicates or else are so close in content that they both cover the same thing, despite a slight difference in wording, it is proper after allowing one claim to object to the other as being a substantial duplicate of the allowed claim. See MPEP § 706.03(k), and **MPEP § 2173.05(n) for undue multiplicity**.

Claim Rejections - 35 USC § 103

10. The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

11. Claims 32-35, 38, 41-44, 47, 50, 51-54, 57, 60-63, 66, 69, 70-73, 76, 79, 81, 83, 85, 87, 89, 91, 93, 95, 97, 99, 100, 102, 103-105, 107-108, 110 and 112-114 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hirano et al [US 5,396,554] in view of Sugiyama [US 6,442,274 B1].

Regarding claim 32, at the outset, it may be noted that claim 32 claims a **leaky recursive least squares (LMS)** version of a standard LMS algorithm to compute the coefficients of an adaptive filter for **updating FIR filter coefficients.** This consists of two terms; weighted previous coefficient value plus a correction term involving a cross-

correction between a receive signal and a delayed transmit signal. However, the LMS algorithm is well-known in the art. In this context, Hirano et al teach an apparatus shown in Figs. 1, 3, for canceling multi-channel echoes including acoustic echo and crosstalk interference [col. 1, lines 14-36; .col. 13, line 29 to col. 14, line 2; col. 17, lines 9-26]. The apparatus comprises an adaptive correlator circuit for calculating cross-correlation functions [col. 13, line 29 to col. 14, line 2], and finite impulse response (FIR) filters to simulate echoes [Fig. 5; col. 17, line 58 to col. 18, line 9]. Inherently, Hirano teaches an adaptation algorithm. For example, Bonnet et al [US 4,852,081] shows a typical form of an adaptation algorithm [Equation (4); col. 2, lines 14-22; Abstract]. To illustrate this cross-correlation technique for updating filter coefficients, Hirano uses a cross-correlation function between two reception signals, 213 and 214, as shown in Fig. 5, based on a tapped-delay line [col. 12, line 14 to col. 14, line 2; col. 14, line 26 to col. 15, line 2]. "While the multi-channel echo canceling apparatus 100 shown in fig. 3 is described **by way of example** in which the first and second reception signals 11 and 12 and the first and second mixed signals 24 and 25 are involved, the present invention can be applied to other cases in which a plurality of reception signals and a single transmission signal or a plurality of transmission signals are involved" [col. 17, lines 9-20]. Further, while the multi-channel echo canceling apparatus is employed to cancel acoustic echoes derived from reception signals , it can be applied to also to the cancellation of crosstalk of a circuit [col. 17, lines 20-26]. In addition, Hirano et al teaches FIR adaptive filters, each having 40 taps [col. 17, line 58 to col. 18, line 10; col. 20, lines 7-28].

Further, Hirano et al teaches a **leaky integration** (i.e. **averaging)** shown in Fig. 7 [col. 15, 15-38] for averaging a variable. However, Hirano does not teach expressly averaging the coefficient of the LMS algorithm.

Sugiyama discloses illustrating the application of a **first-order leaky integration** method which is one of several averaging methods well-known in the art [col. 4, lines 51-57; Equation 1]. This integration method is essentially a low-pass recursive filter. However, this is nevertheless a teaching to one of ordinary skill in the art to apply this averaging technique to other applications.

At the time of the invention, it would have been obvious to a person of ordinary skill in the art to apply the first-order leaky integration to the coefficient of the LMS algorithm of Hirano et al in order to obtain a stable value (i.e. **averaged value)** of the LMS coefficient in the presence of noise in an echo cancellation system. As a result, this averaging of the coefficient of the LMS algorithm through the recursive filter (i.e. leaky integrator) compensates for a susceptibility of noise in echo cancellers [Sugiyama; col. 5, line 65 to col. 6, line 13; col. 23, lines 21-28].

Claims 41, 50, 51, 60, 69, 70, 99, 103, 112 are essentially similar to Claim 32 and are rejected for the reasons stated above.

Claim 102 is essentially similar to claim 32 except for leakage factors. The combination of Hirano et al and Sugiyama teaches a leaky LMS algorithm comprising the corresponding coefficients from the previous time period weighted by a first predetermined weighing factor, (1-β) and the product of the signal received by the receiver during the previous time period and the signal transmitter delayed by the predetermined time are weighted by a second predetermined weighing factor, β, as shown above.

Claims 107, 110 are essentially similar to claim 102 and are rejected for the reasons stated above.

Regarding claims 33 and 34, the combination of Hirano et al and Sugiyama teaches a leaky LMS algorithm comprising the corresponding coefficients from the previous time period weighted by a first predetermined weighing factor, (1-β) and the product of the signal received by the receiver during the previous time period and the signal transmitter delayed by the predetermined time are weighted by a second predetermined weighing factor, β, as shown above.

Claims 42-43, 52-53, 61-62 and 71-72 are essentially similar to Claims 33-34 and are rejected for the reasons stated above.

Regarding claim 35, see Fig. 5 of Hirano et al.

Claims 38, 44, 47, 54, 57, 63, 66, 73, 76 are essentially similar to Claim 35 and are rejected for the reasons stated above.

Claim 79 is essentially similar to claims 33 and 34 except a normalization factor for the LMS algorithm. Hirano et al teach a normalized LMS algorithm [Equation (35); col. 17, lines 20-52].

Claims 81, 83, 85, 87, 89, 91, 93, 95, 97, 100, 105, and 114 are essentially similar to claim 79 and are rejected for the reasons stated above apropos of claim 79.

Regarding claim 104, Hirano et al teach a finite Impulse response filter (FIR) with a receiver and LMS engine to cancel near-end echo and crosstalk interference [Fig. 2; col. 5, line 36 to col. 6, line 68; col. 17, lines 9-52; col. 17, line 58 to col. 18, line 9].

Claim 108 is essentially similar to claim 104 and is rejected for the reasons stated above apropos of claim 104.

Claim 113 is essentially similar to claim 104 and is rejected for the reasons stated above.

12. Claims 32, 38, 51, 57, 70, 76 are rejected under 35 U.S.C. 103(a) as being unpatentable over Traill et al [US 6,078,567] in view of Sugiyama [US 6,442,274 B1].

Regarding Claim 32, Traill et al teaches using cross-correlation of receive and transmit signals to determine filter coefficients for canceling echo and crosstalk interference shown in Figs. 1-3 [col. 1, lines 14-37; col. 2, line 31 to col. 3, line 31]. Inherently, Traill et al teaches an adaptation algorithm. For example, Bonnet et al [US 4,852,081] shows a typical form of an adaptation algorithm [Equation (4); col. 2, lines 14-22; Abstract]. The echo detection device 6 uses a cross-correlation technique to compare speech on the reflected and transmitted paths with a predetermined delay [col. 5, lines 58-67], wherein the predetermined delay can be determined using elemental delays imposed on the transmitted signal [col. 6, lines 1-27; col. 9, lines 22-25; col. 10, lines 10-13]. Traill et al also discloses using normalized signals for cross-correlation [col. 8, lines 22 –64]. In addition, **Traill et al simply refers to Taguchi [US 5,062,102] for more details** (which are inherently present in Traill et al), such as filter coefficient update equations based on a cross-correlation technique between the signals carried by first and second transmission lines [col. 2, lines 21-29], and **does not duplicate those equations of Taguchi in describing his instant invention**. In this context, Taguchi discloses cross-correlation coefficient calculator 24 for delivering the values of b_0 through b_n to the transversal filter 16 as the filter coefficients [Fig. 3; Equation 6; col. 5, lines 30-55; col. 7, lines 35-68].

Trail et al do not teach a **leaky integration** (i.e. **averaging)** shown in Fig. 7 [col. 15, 15-38] for averaging a variable.

Sugiyama discloses illustrating the application of a **first-order leaky integration** method which is one of several averaging methods well-known in the art [col. 4, lines 51-57; Equation 1]. This integration method is essentially a low-pass recursive filter. However, this is nevertheless a teaching to one of ordinary skill in the art to apply this averaging technique to other applications.

At the time of the invention, it would have been obvious to a person of ordinary skill in the art to apply the first-order leaky integration to the coefficient of the LMS algorithm of Trail et al in order to obtain a stable value (i.e. **averaged value)** of the LMS coefficient in the presence of noise in an echo cancellation system. As a result, this averaging of the coefficient of the LMS algorithm through the recursive filter (i.e. leaky integrator) compensates for a susceptibility of noise in echo cancellers [Sugiyama; col. 5, line 65 to col. 6, line 13; col. 23, lines 21-28].

Claims 51 and 70 are essentially similar to Claim 32 and are rejected for the reasons stated above apropos of Claim 32.

Regarding Claim 38, the use of a shift register in the FIR filter is well-known in the art. See Taguchi [Fig. 6, elements, 53 and 63; col. 8, lines 48-66; col. 9, lines 25-43; col. 12, lines 12-28].

Claims 57 and 76 are essentially similar to Claim 38 and are rejected for the reasons stated above apropos of Claim 38.

13. Claims 36, 39, 45, 48, 55, 58, 64, 67, 74 and 77 are rejected under 35 U.S.C. 103(a) as being unpatentable over the combination of Hirano et al and Sugiyama as applied to claims 35, 38, 44, 47, 54, 57, 63, 66, 73 and 76 above, and further in view of Chevreau et al [US 4,571,720].

Regarding claim 36, the combination of Hirano et al and Sugiyama teaches a leaky LMS algorithm comprising the corresponding coefficients from the previous time period weighted by a first predetermined weighing factor, (1-β) and the product of the signal received by the receiver during the previous time period and the signal transmitter delayed by the predetermined time are weighted by a second predetermined weighing factor, β, as shown above. In addition, the combination of Hirano et al and Sugiyama teaches a normalized LMS (NLMS) algorithm [Hirano et al; Equation (35); col. 17, lines 20-52].

The combination of Hirano et al and Sugiyama does not teach using an inverse of a variance of the signal transmitted by the transmitter. It is well-known in the art that the use of a normalization factor is a design parameter that depends on a specific application. For example, Chevreau et al disclose using a normalization factor containing a variance of the transmitted data (i.e. **symbols)** [Equation (1); col. 1, lines 18-50].

At the time of the invention, it would have been obvious to a person of ordinary skill in the art to define and determine a suitable normalization factor to meet the performance specification of the echo canceller subject to circuit, system and design constraints.

Claims 39, 45, 48, 55, 58, 64, 67, 74 and 77 are essentially similar to claim 36 and are rejected for the reasons stated above apropos of claim 36.

14. Claims 37, 40, 46, 49, 56, 59, 65, 68, 75, 78, 80, 82, 84, 86, 88, 90, 92, 94, 96, 98, 101, 106, 109, 111 and 115 rejected under 35 U.S.C. 103(a) as being unpatentable over the combination of Hirano et al and Sugiyama as applied to claims 35, 38, 44, 47, 54, 57, 63, 66, 73, 76, 79, 81, 83, 85, 87, 89, 91, 93, 95, 97, 100, 105, 107, 110 and 114 above.

Regarding claim 37, the combination of Hirano et al and Sugiyama does not teach the second weighting factor as an inverse of a number of a group of the signals transmitted by the transmitter. Hirano et al teach a value of the second weighting factor, β, between 1 and 0. Since β is a design parameter, the specific value depends on a specific application.

At the time of the invention, it would have been obvious to a person of ordinary skill in the art to determine a suitable of the design parameter, β, to meet the performance specification of the echo canceller subject to circuit, system and design constraints.

Claims 40, 46, 49, 56, 59, 65, 68, 75, 78, 80, 82, 84, 86, 88, 90, 92, 94, 96, 98, 101, 106, 109, 111 and 115 are essentially similar to claim 37 and are rejected for the reasons stated above apropos of claim 37.

Conclusion

15, Any inquiry concerning this communication or earlier communications from the examiner should be directed to Ramnandan Singh whose telephone number is (703)308-6270. The examiner can normally be reached on M-F(8:00-4:30).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Forester Isen can be reached on (703)-305-4386. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Ramnandan Singh
Examiner
Art Unit 2644